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House Appropriation Committee
STATEMENT TO BUDGET-OFFICIALS

by

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Dr. Hunsaker has described the events of the last year which influence the direction and magnitude of the effort which should be devoted to aeronautical research. Responding to these events the Committee has recommended an increase in operating expenditures from the present figure of 0.4 percent to 0.6 percent of the average annual sum expended for procurement of military aircraft during a war year. The measure of the proposed research effort is indicated on the first chart. The requested annual expenditure for research represents about twice the development cost of a single new aircraft engine.

Last year we described to you the technical revolution inaugurated by the development of jet and rocket power plants which paved the way for the attainment of much higher flight speeds than possible with reciprocating engines and propellers. We reviewed the relation of speed of aircraft air power. Aircraft having the highest speed dominate the air. We stated that it was then abundantly clear that there is no barrier to tremendous increases in the possible speed of aircraft and that any nation which made the effort could lead the world in air power. We forecast then that we would soon see piloted aircraft continuously propelled in horizontal flight at supersonic speeds, that the attainment of that goal was one of the objectives of present-day aeronautical development, that much of the Committee's effort was directed toward that objective, and that a most important part of the effort was the flight research on high-speed research airplanes at Muroc, California, conducted in cooperation with the military services and the aircraft industry.

Progress has been even more rapid than expected as you are well aware.

The chart shows the comparatively brief period during which the speed frontier was moved through the feared sonic barrier. The chart does not show the extensive measurements on models in wind tunnels and on rocket-propelled models in free flight which were conducted during the preceding three years on the basis of which our predictions of last year were made. No unforeseen difficulties were encountered in pushing this research airplane of conventional subsonic design through the sonic barrier by the concentrated power of its rocket motors. The flights gave invaluable data on the aerodynamic characteristics of the conventional configuration at transonic speeds and in particular on the applicability of other methods of obtaining data in this region. They did not represent the achievement of a tactically useful aircraft. The NACA's contribution to this achievement was recognized by the fact that Mr. John Stack, of the Committee's staff, shared the Collier Trophy for 1947 with Captain Jaeger, the Air Force pilot, and Lawrence Bell, the manufacturer.

The X-1 is a small research airplane carrying no military load and with a short flight duration. Nevertheless its achievements have had a profound psychological effect in dispelling fear of unknown and unanticipated phenomena in the transonic region and engendering new confidence in the use of models in wind tunnels and free flight as a means of obtaining design data for use in the design of tactical airplanes. New vistas are thus opened not only for initiating the design of new aircraft but for improving the performance of aircraft currently under development. The next chart shows, as an example, the present speed goals which the designers of certain military aircraft are setting up for the later versions of aircraft now going into or about to go into production. I must emphasize that these goals do not represent specifications

established by the military services or performances guaranteed by the manufacturer; they are the goals which the designers have set for themselves as revealed in their discussions with members of our staff.

On May 7, 1948, after the technical results obtained in the X-1 flights were made available to designers, the NACA Committee on Aerodynamics expressed concern over the need for additional information on the problems of flight at speeds in excess of 0.9, the speed of sound, and suggested the appointment of a special ad hoc subcommittee to recommend the direction and concentration of effort in NACA's critical transonic research facilities. This recommendation was favorably received by the NACA at its May 28 meeting and the Special Committee on the Research Problems of Transonic Aircraft Design was appointed. It consisted of the designer of every military aircraft, and representatives of the military services, and of the NACA. Recommendations made as to the present program are being put into effect. Other recommendations are reflected in these budget estimates, namely, "it is very urgently recommended that steps be taken without delay to increase by at least a factor of 3 the productivity of rocket-propelled-model research facilities in the transonic range," and "in view of a critical shortage and the virtual non-existence, except for free-flight procedures, of methods for obtaining reliable transonic data at adequate Reynolds numbers, it is recommended that the NACA continue under as high priority as possible the study, development, and procurement of test facilities for obtaining reliable aerodynamic data through the transonic ranges."

It should be noted, as Dr. Hunsaker mentioned, that the X-1 flights transformed the transonic region from a region to be avoided and traversed rapidly, and hence of minor importance, to a region in which aircraft can and will be operated with safety if sufficient quantitative data on aerodynamic

behavior are available. Hence the increased priority of transonic data which have appeared since the X-1 flight. Incidentally, the summary of recommendations of this special committee, which has been compiled by the aerodynamic-research branch, NACA Headquarters, with its enclosures, is an excellent illustration of the effective method used in coordinating our research programs with development needs and with industry and military opinion.

The next chart is one which we showed you last year to illustrate the variety of the aerodynamic problems to be solved for the transonic speed range. As will be discussed in more detail by Mr. Robinson, the most crucial problems are those of stability and control through the transonic range. These are, however, not the only problems. The X-1 had a conventional subsonic configuration, it was built with great structural strength, and it was driven at high speed by a rocket for a brief time. To secure useful tactical aircraft, other configurations must be used which have less drag. You are familiar with the new look as illustrated by the F-86, the first of the new type employing sweptback wings. Such new configurations give additional problems at low speeds, especially in the landing condition. Hence the concentration of effort in transonic aerodynamics cannot be accomplished by curtailing the operation of low-speed facilities.

The rocket is not a suitable main power plant for any other than a very special type of interceptor aircraft. It is likely that the tactical transonic airplanes will be powered by turbo-jet engines equipped with afterburners, as illustrated in the next chart, although turbo-jet engines with auxiliary rockets are possible competitors. The advantage of the afterburner is that it uses the same fuel as the turbo-jet engine itself. There are many developments in power plants which must be thoroughly tested and brought to practical application. During the past year the NACA has been studying various methods of improving the

performance of turbo-jet engines and some of these methods could be applied to specific aircraft at a considerably earlier date if more manpower were now devoted to them. Mr. Rothrock will later tell you about the advantages to be gained from supersonic compressors and turbine-blade cooling.

The turbo-jet with afterburner is shown in some of the research problems connected with its development. The next chart shows the present region of application of the several types of power plants. Much publicity has recently been given to the compound engine in which energy is recovered from the exhaust of a reciprocating engine by the use of turbines as an engine suitable for long-range aircraft. It is interesting that a survey report of NACA research in this field was presented to the SAE in April 1946. The turbo-propeller power plant is likewise being applied to long-range aircraft, and its field, as well as that of the compound engine, will be greatly affected by the results of research now in progress on propellers for high-speed aircraft.

These are some of the highlights of the programs of most concern to military aviation relating to research results which are close to application and capable of being expedited by increased manpower. The total program of the Committee includes work specifically related to commercial aircraft, to small aircraft for personal use, and to rotating-wing aircraft.

Although the NACA's estimates for 1950 call for the employment of additional personnel to permit an expansion of research effort, the program which they represent is considered the minimum consistent with the state of the art, the urgency from the standpoint of national security, and the availability of personnel. In summary, the additional personnel requested are required to permit (1) the full staffing of recently completed facilities and the staffing of facilities to be placed in initial operation during the fiscal year 1950,

(2) the increased utilization of existing facilities at all laboratories, particularly those supplying research data in the transonic and supersonic speed ranges, and (3) an expansion of the research programs at the pilotless aircraft research station at Wallops Island, Virginia, and at the flight research station at the Muroc Air Force Base, California. About two-thirds of the personnel requested are supporting personnel for the one-third who are research professionals.

I would now like to ask Mr. Crowley to report specifically on the research-airplane program.